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KERN COUNTY FLOOD INSURANCE STUDY

SUMMARY OF HYDROLOGIC ANALYSES
COTTONWOOD, ERSKINE, AND KELSO CREEKS

KERN COUNTY, CALIFORNIA

JULY 1979

SUMMARY OF HYDROLOGIC ANALYSES

1.0 INTRODUCTION

This report presents the hydrologic analyses and conclusions developed for Cottonwood, Erskine and Kelso watersheds as a part of the Flood Insurance Study for Kern County, California. The hydrologic analysis used the Soil Conservation Service (SCS) Method, Computer Program for Project Formulation - Hydrology (TR-20). Peak flood flows with 10-, 50-, and 100-year return periods were computed for tributary drainage areas and main stream channels within the drainage areas. For the purpose of analysis, the basins were divided into a number of subdrainage areas. Plate I shows the location of the watersheds, and the two gaging stations.

2.0 PROCEDURE

2.1 Precipitation Data. Precipitation data were obtained from the National Oceanic and Atmospheric Administration (NOAA) Precipitation-Duration-Frequency maps of the State of California. The 10-, 50-, and 100-year, 24- and 6-hour precipitation isopluvial maps provided the basis for estimating the rainfall intensities for each of the subdrainage areas.

2.2 Curve Numbers. The curve numbers were obtained from an overlay of the hydrologic soils group and current land use. The Kern County Water Agency (KCWA) provided curve numbers for areas of federal land in Erskine and Kelso watersheds where there is no hydrologic soils mapping.

2.3 Time of Concentration. Three methods were used to estimate time of concentration: Kirpich Formula; Corps of Engineers (COE) Method; and Curve-Number Method (Eq. 15.4, SCS, National Engineering Handbook,

Section 4). The final time of concentration was selected based on an analysis of the velocities related to each method.

2.4 Storm Types. The SCS has developed storm types for use in hydrologic analyses which represent the rainfall intensities at all times during the storm duration. The type of storm distribution was obtained using the guidelines specified in Chapter Two, "Estimating Runoff in California," of the Soil Conservation Service, Engineering Field Manual, Supplement 1; and the Soil Conservation Service Technical Note - Hydrology, PO-2, "Estimating Peak Discharges for Watershed Evaluation Storms and Preliminary Designs," June, 1970.

2.5 Calibration. There are two gaging stations on Kelso Creek. Prior to its conversion to a low-flow, partial-record station, Gage 11-1897 had a continuous record of nine years (1959-1967). The other station, Gage 11-1898, is a crest-stage partial-record station established in 1975. Station 11-1915 is a crest-stage, partial-record station on Erskine Creek with records beginning water year 1976. None of these records is long enough to provide data for a reliable flood frequency analysis. It was not possible to extend the nine years of record of Kelso Creek based on the 24-years record of Kern River at Kernville because the correlation coefficient was less than 0.80.

However, the TR-20 model had been adjusted already, using the flood frequency curves developed by log-Pearson III analysis of two USGS gaging stations in the adjacent Caliente basin. The same storm pattern, rainfall intensity, and antecedent moisture conditions consequently were used in

analyzing Cottonwood, Kelso and Erskine watersheds. Thus, peak flows for the 100-year and 10-year events were obtained using an antecedent moisture condition of II and I, respectively. The curve numbers shown in Plates II and III were modified for 50-year flow to reflect an intermediate moisture condition between I and II. This was done to match the slope of the frequency curves of the gaging stations.

The frequency curves resulting from the above analysis were plotted together with curves derived from gaging station data (Plate IV). These gages are in the same region of Kern County as the three watersheds. The purpose was to compare slopes. The slopes are similar, so no further calibration was considered necessary.

One hundred-year peaks were also compared among Kelso, Cottonwood, Erskine and the gaged streams. Plate V shows the results. The 100-year peaks of the three streams are within the limits of other peak estimates.

Finally, a special comparison was made among three flood frequency curves for Kelso Creek (Plate VI). One curve is a composite of winter and summer curves derived from KCWA equations (Procedure for Derivation of Flood Peaks, Hydrologic Areas II and III, Kern County, April 1976, revised December 1978). Another curve is based on a log-Pearson III analysis of the nine-year gaging station record. The third curve was derived by Boyle Engineering Corporation in its TR-20 analysis, and falls between the two other curves.

3.0 SCHEMATIC

Plates II and III are the schematics showing the stream system of the three watersheds. These schematics indicate all the input elements of a TR-20 model concerning the time of concentration, soil and watershed characteristics, and the elements of routing between concentration points.

4.0 EXISTING INFORMATION

4.1 Cottonwood Creek. There is no existing hydrology for this stream.

4.2 Erskine Creek. In May 1977, the KCWA produced a 100-year flood plain delineation for Erskine Creek near its mouth. The maps were based on an estimated 100-year peak flow of 7,400 cfs, derived from the Agency's Area III Hydrology Criteria.

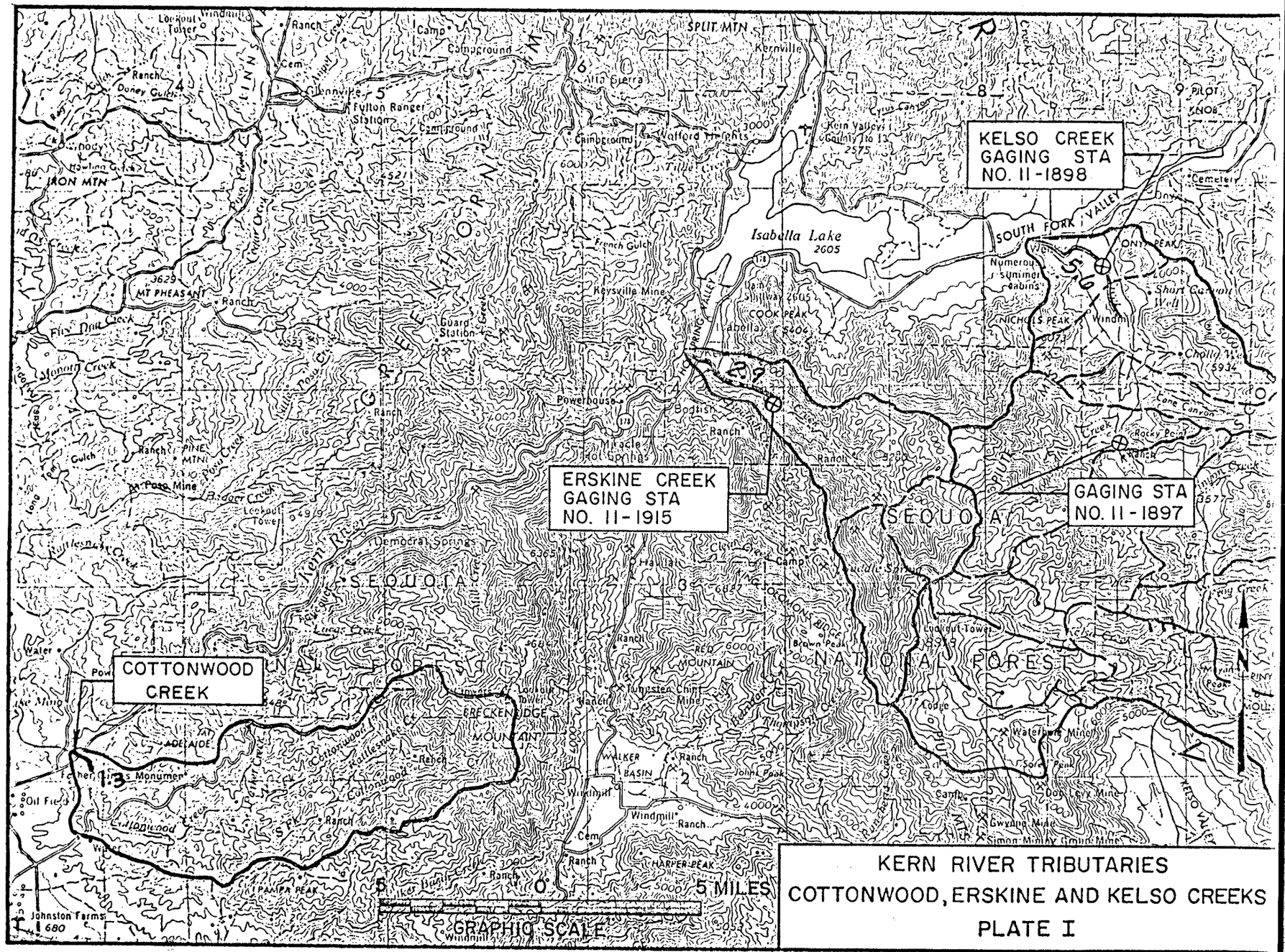
4.3 Kelso Creek. In April 1978 the COE developed a preliminary flood frequency curve on the basis of several local factors. The COE has stated that the results are not applicable to Flood Insurance Studies. However, we compared the curve with the one obtained from the SCS TR-20 analysis and found that only the slopes are similar.

5.0 RESULTS

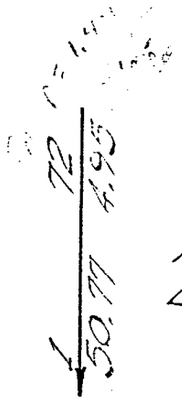
The results are as shown in the following Table.

TABLE I

Stream	Drainage Area	Frequency (Years) 10-Year	50-Year	100-Year
Cottonwood	50.77 sq.mi.	500 cfs	2550 cfs	5600 cfs
Erskine	34.72	2750	6900	11200
Kelso	159.54	2850	11000	22700

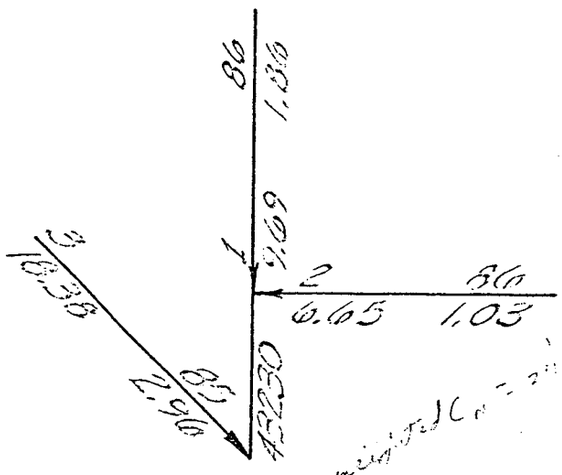


KERN RIVER TRIBUTARIES
COTTONWOOD, ERSKINE AND KELSO CREEKS
PLATE I



REACH LENGTH = ENTIRE BASIN

COTTONWOOD CREEK



$t_c = 30.00 + 16.47 - 45.0 = 85.47$

$R = 1.71$ ✓

AGENCY $A = 1.716$

ERSKINE CREEK

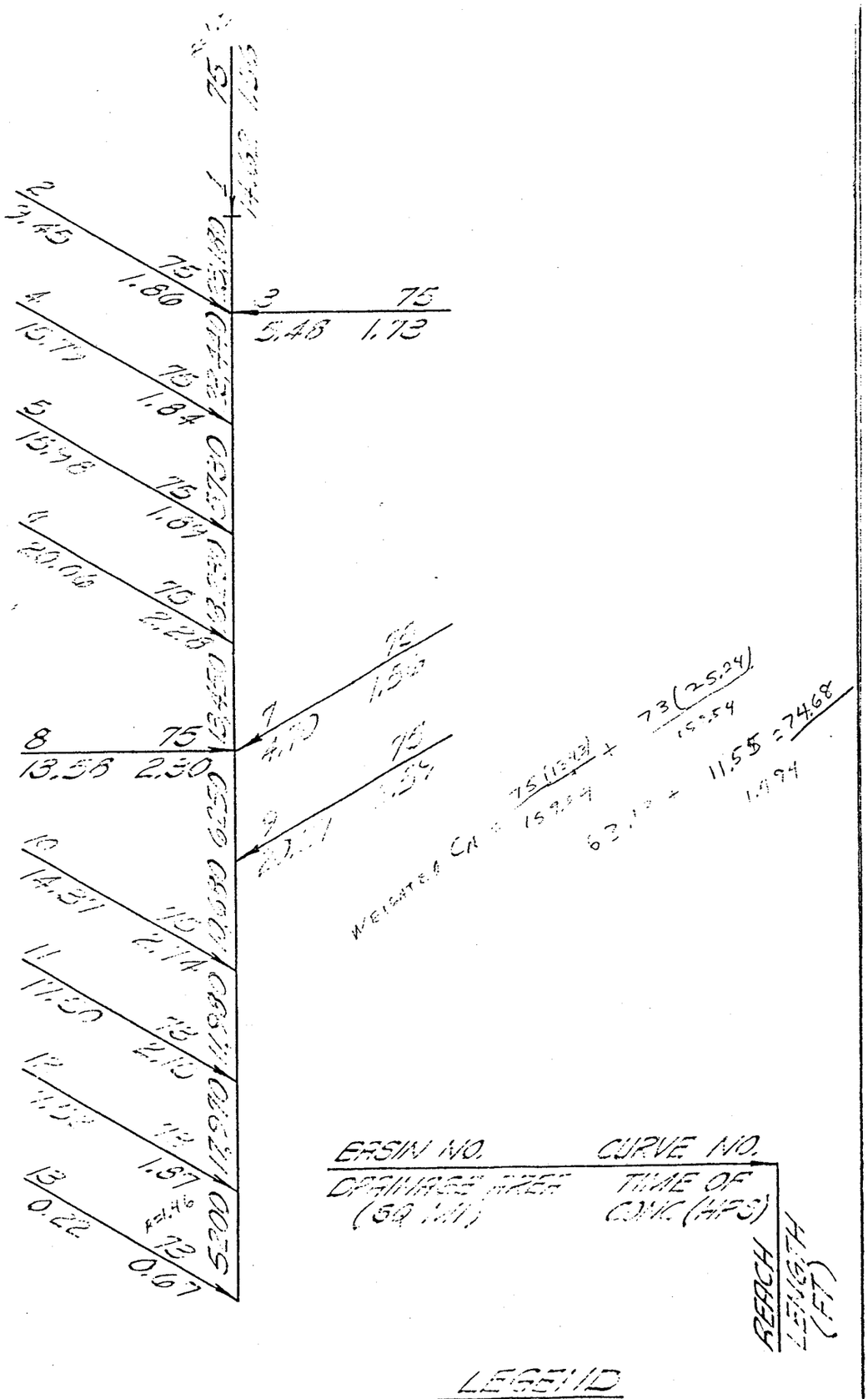
BASIN NO. CURVE NO.
DRAINAGE AREA (SQ MI) TIME OF CONC (HRS)
REACH LENGTH (MI)

LEGEND

HYDROLOGIC SCHEMATIC

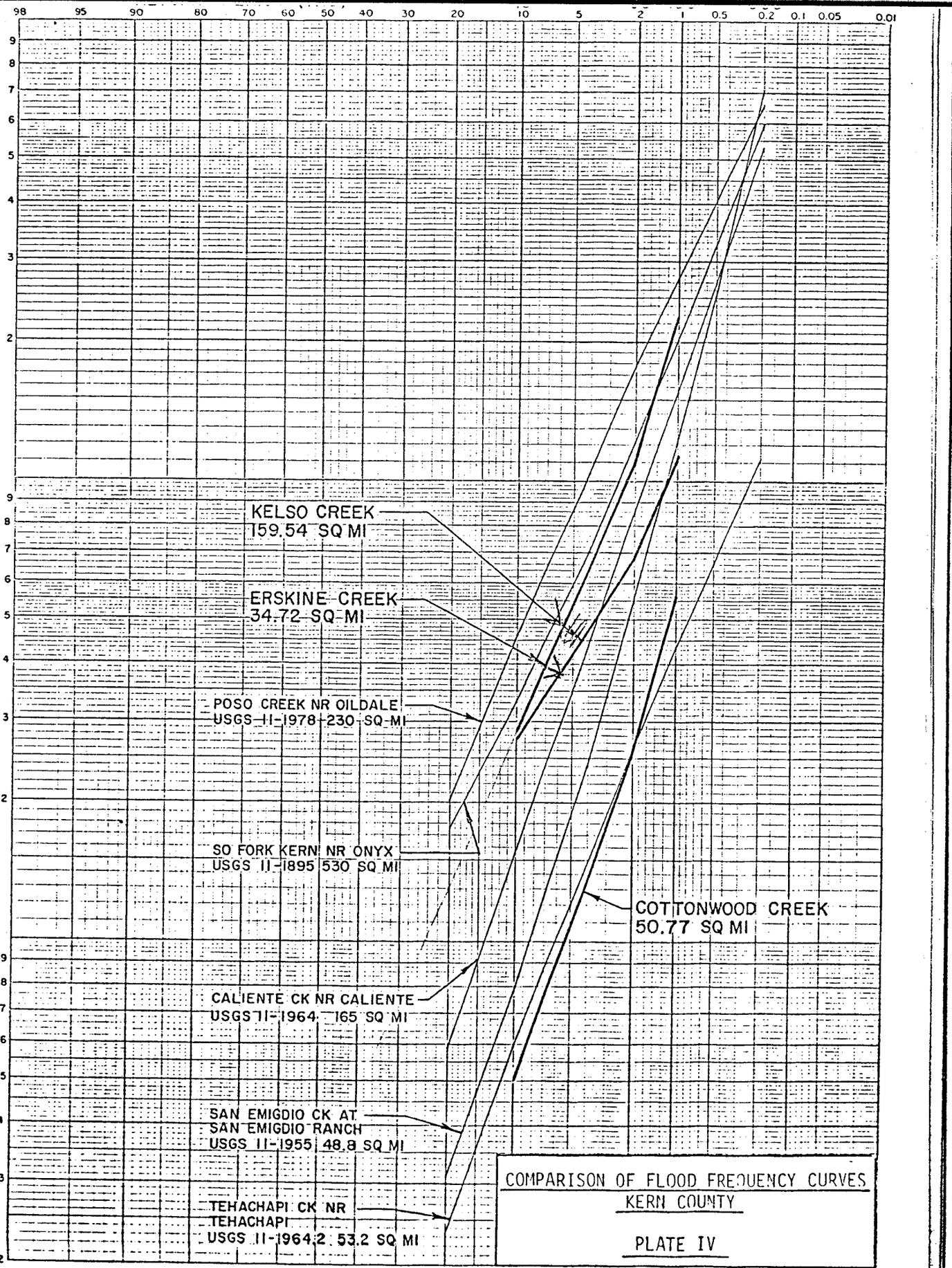
FOR COTTONWOOD CREEK AND ERSKINE CREEK

PLATE II



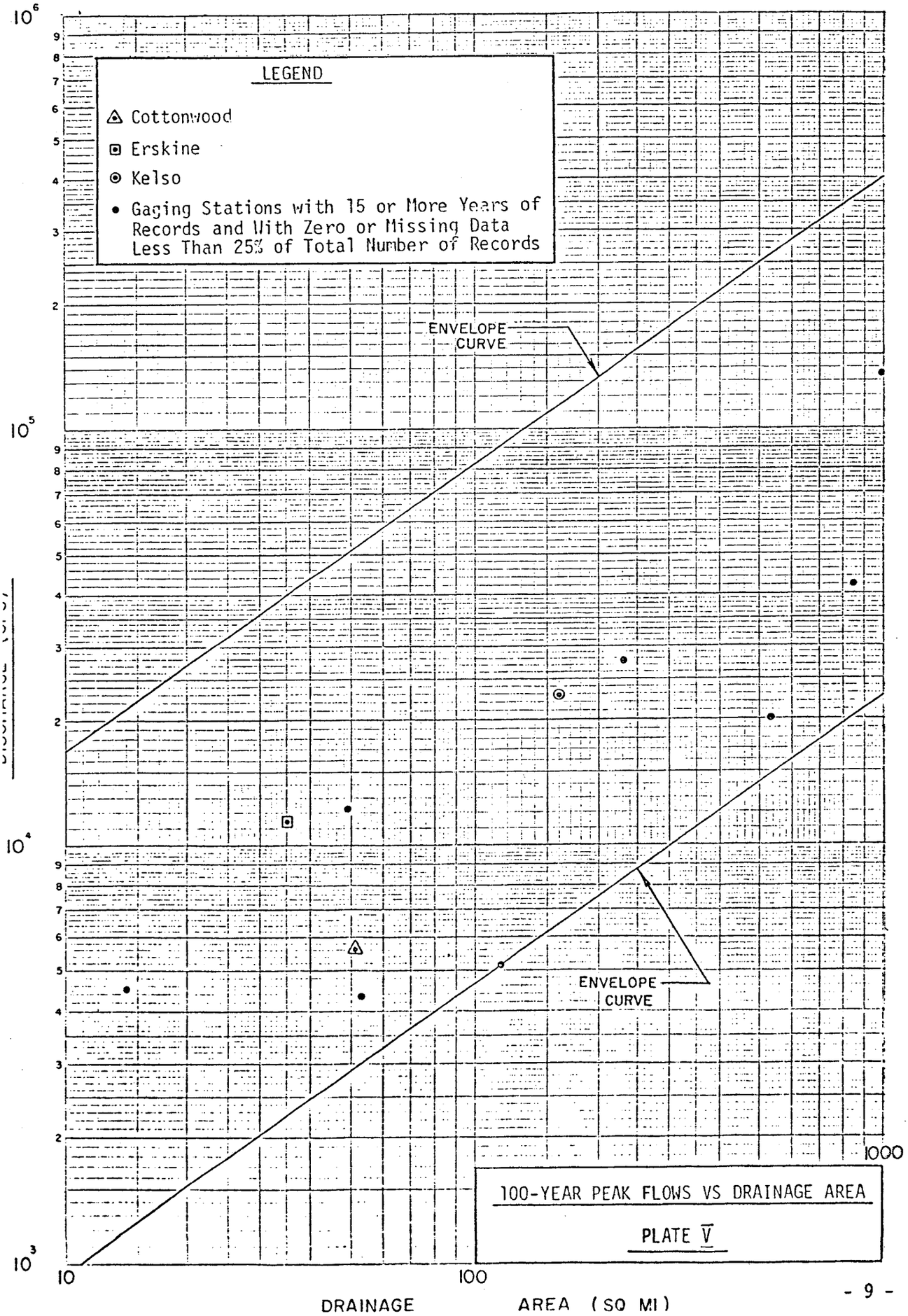
HYDROLOGIC SCHEMATIC FOR KELSO CREEK

PLATE III



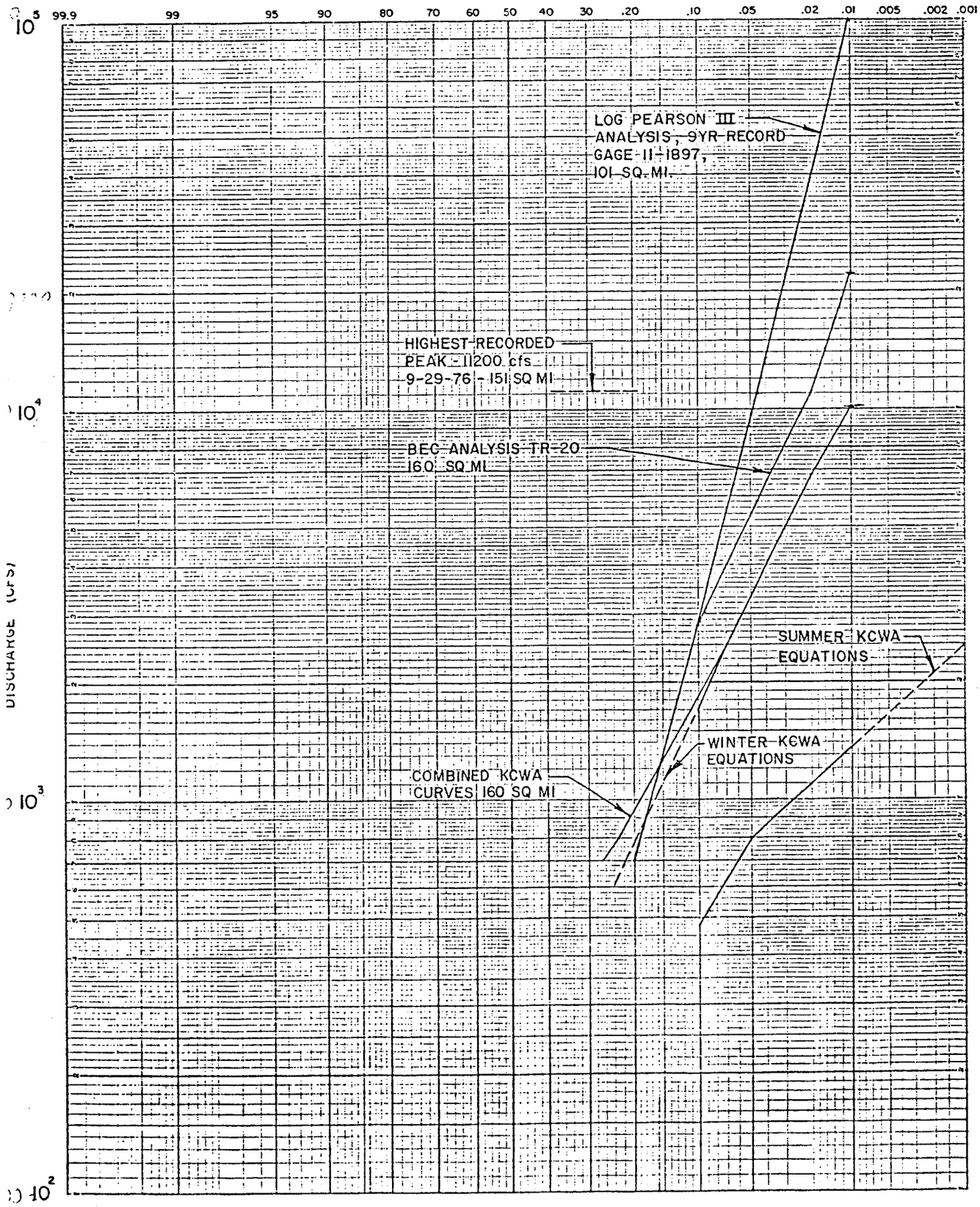
COMPARISON OF FLOOD FREQUENCY CURVES
KERN COUNTY

PLATE IV



100-YEAR PEAK FLOWS VS DRAINAGE AREA

PLATE V



KELSO CREEK

COMPARISON OF FLOOD FREQUENCY CURVES

PLATE VI